Combustion: DNS of Turbulent Jet Flames

Objective: Understand flame structure in future engines using lean fuels, dilute concentrations, and/or higher pressures to achieve higher combustion efficiencies.

Implications: Can lead the nation toward the goal of increased energy efficiency and decreased emissions.

Accomplishments: Direct numerical simulations (DNS) of turbulent plane CO/H_2 jet flames using S3D to examine lower-dimensional approximations to the scalar dissipation rate – something that is vital to understand but notoriously hard to measure.

• Good agreement between newly-developed theoretical treatment and simulated results.

NERSC:

• 620K alloc., jobs use up to 2,525 Franklin nodes

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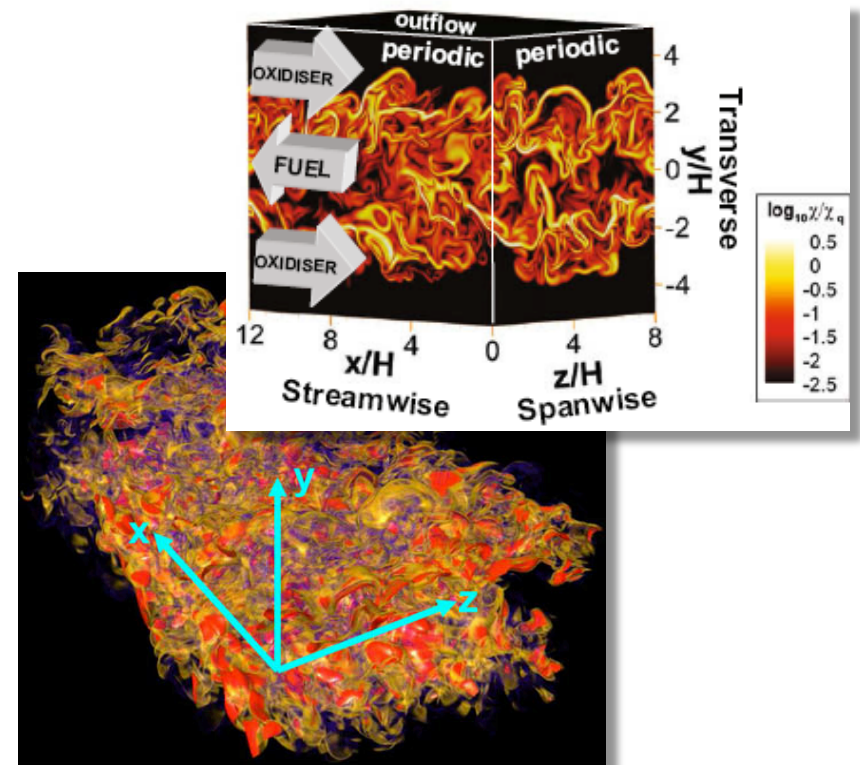
Two volume renderings using the entire 500 million grid point field show the scalar dissipation rate

Proc. of the Comb. Inst. (2009)